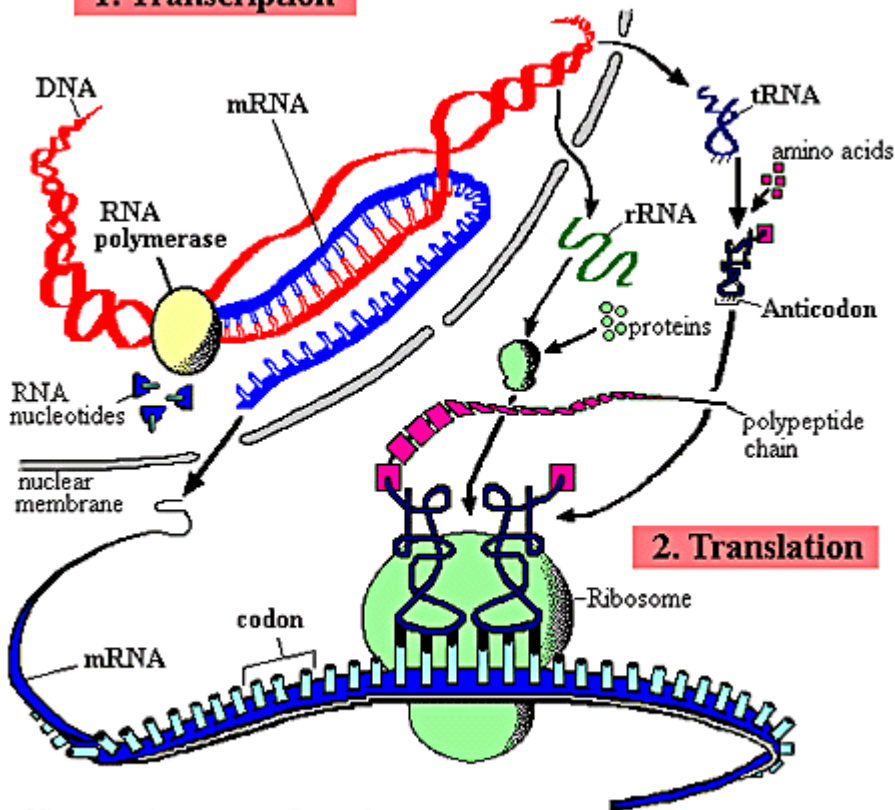


# Protein Synthesis

## 1. Transcription



## Protein synthesis

Legend:

Process whereby DNA encodes for the production of amino acids and proteins.

This process can be divided into two parts:

### 1. Transcription

Before the synthesis of a protein begins, the corresponding RNA molecule is produced by RNA transcription. One strand of the DNA double helix is used as a template by the RNA polymerase to synthesize a messenger RNA (mRNA). This mRNA migrates from the nucleus to the cytoplasm. During this step, mRNA goes through different types of maturation including one called **splicing** when the non-coding sequences are eliminated. The coding mRNA sequence can be described as a unit of three nucleotides called a codon.

### 2. Translation

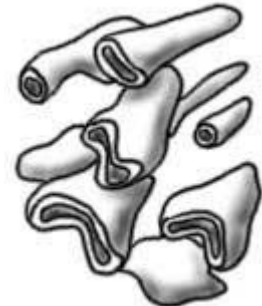
The ribosome binds to the mRNA at the start codon (AUG) that is recognized only by the initiator tRNA. The ribosome proceeds to the elongation phase of protein synthesis. During this stage, complexes, composed of an amino acid linked to tRNA, sequentially bind to the appropriate codon in mRNA by forming complementary base pairs with the tRNA anticodon. The ribosome moves from codon to codon along the mRNA. Amino acids are added one by one, translated into polypeptidic sequences dictated by DNA and represented by mRNA. At the end, a release factor binds to the stop codon, terminating translation and releasing the complete polypeptide from the ribosome.

## Endoplasmic Reticulum

Another **organelle** in the cell is the **endoplasmic reticulum** (ER). While the function of the [nucleus](#) is to act as the cell brain, the ER functions as a **packaging system**. It does not work alone. The ER works closely with the [Golgi apparatus](#), [ribosomes](#), RNA, mRNA, and tRNA. It creates a network of membranes found through the whole cell. The ER may also look different from cell to cell, depending on the cell's function.

### Rough and Smooth

As you learn more about cells you will discover two types of ER. There are rough ER and smooth ER. They both have the same types of membranes but they have different shapes and rough ER has ribosomes attached. Rough ER looks like sheets of bumpy membranes while smooth ER looks more like tubes. Sometimes the ER looks like a flat balloon. Sacs of the ER called **cisternae** store the complex molecules.



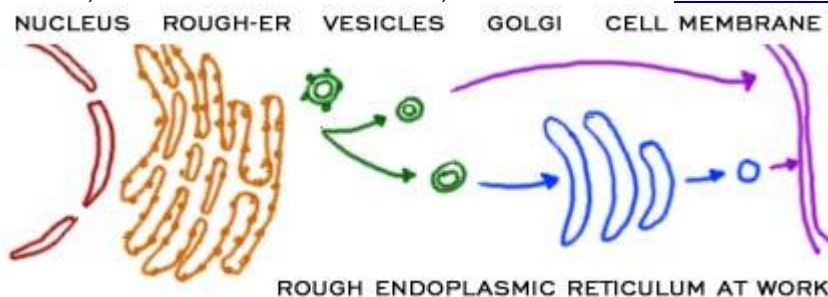
SMOOTH ER



ROUGH ER

**Smooth ER** has its purpose in the cell. It acts as a storage organelle. It is important in the creation and storage of **steroids**. It also stores **ions** in solution that the cell may need at a later time. Steroids are a type of ringed organic molecule used for many purposes in an organism. They are not always about building muscle mass like a weight lifter. The ion storage is important because sometimes a cell needs ions fast. It might not want to search the environment for ions, so it is easier to have them stored in a pack for easy use.

**Rough ER** was mentioned in the section on ribosomes. They are very important in the synthesis and packaging of **proteins**. Some of those proteins might be used in the cell and some are sent out. The ribosomes are attached to the membrane of the ER. As the ribosome builds the amino acid chain, the chain is pushed into the ER. When the protein is complete, the rough ER pinches off a vesicle. That vesicle, a small membrane bubble, can move to the [cell membrane](#) or the Golgi apparatus.



ROUGH ENDOPLASMIC RETICULUM AT WORK